Criteria for Evaluating Mathematics Instructional Resources

Adopted by State Board of Education
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Introduction

Instructional materials adopted by the state must help teachers present the content set forth in the *Mathematics Content Standards*. To accomplish this purpose, this document establishes the criteria for evaluating the instructional materials. These criteria serve as evaluation guidelines for the statewide adoption of mathematics instructional materials in kindergarten through grade eight for the 2001 Adoption of Mathematics Instructional Resources.

The California mathematics standards are challenging. In the initial years of implementing the *Mathematics Framework*, a major goal for most school districts across the state will be to facilitate the transition from what students actually know to what the *Mathematics Content Standards* envisions they should know. Instructional materials play a central role in facilitating this transition.

Publishers are encouraged to design instructional materials specifically for use during this transition period. Materials that will help districts meet this challenge will clearly identify the highest-priority instructional activities and will allow teachers to focus instruction in those areas as necessary. During this transition school districts may need to allocate more time to mathematics instruction than they will in subsequent years.

Instructional materials adopted by the State Board of Education, on the whole, should provide programs that will be effective for all students-those who have not mastered most of the content taught in the earlier grades and those who have. In addition, some instructional materials must specifically address the needs of teachers who instruct a diverse student population. Therefore, the *Mathematics*

Framework does not ask publishers to use a particular pedagogical approach; instead, it encourages them to select research-based pedagogical approaches that collectively give teachers alternatives that will help them in teaching mathematics effectively.

Evaluation Criteria

The criteria for evaluation K-8 mathematics instructional resources are organized into five general categories, followed by a section on suggestions for optional criteria for publishers who choose to develop transition materials (transitional materials will be considered as part of the Universal Access criterion):

1. *Mathematical content/alignment with the standards.* The content as specified in the *Mathematics Content Standards* and elaborated on in the framework
2. *Program organization.* The sequence and organization of the mathematics program that provides structure to what students should learn each year
3. *Assessment.* The strategies presented in the instructional materials for measuring what students know and are able to do
4. *Universal access.* The information and ideas that address the needs of special student populations, including students eligible for special education, students whose English-language proficiency is significantly lower than that typical of their class or grade level, students whose achievement is either significantly below or above that typical of their class or grade level, and students who are at risk of failing mathematics
5. *Instructional planning and support.* The instructional planning and support information and materials, typically including a separate edition specially designed for use by the teacher, that help teachers in implementing the mathematics program

Mathematics Content/Alignment with the Standards

Mathematics materials should support teaching to the mathematics content standards. In kindergarten through grade seven, the standards are organized in five strands: Number Sense; Algebra and Functions; Measurement and Geometry; Statistics, Data Analysis, and Probability; and Mathematical Reasoning. However, there is no requirement that publishers adhere to this strand organization as long as they address all the individual standards. In grades eight through twelve, the standards are organized by discipline. Some

schools teach the grade eight through twelve mathematics curriculum in traditional courses, and others teach it in an integrated fashion.[1] To provide local educational agencies and teachers with flexibility in presenting the material, the standards for grades eight through twelve do not mandate that a particular discipline be initiated and completed in a single grade. Nevertheless, however mathematics is taught, the core content of these subjects must be covered; and all academic standards for achievement must be the same.

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[1] Note: If a publisher submits an integrated program for grade eight, the entire program series must be submitted (e.g., to evaluate a 3-year integrated algebra I/geometry/algebra II series, materials for all 3-years of the program would be reviewed to determine alignment with the algebra I standards).

Materials that fail to provide thorough instruction on the standards and the mathematics content described in the framework will not be considered for adoption.

Materials aligned with the mathematics content standards must satisfy the following criteria:

- The content supports teaching the mathematics standards at each grade level (as detailed, discussed, and prioritized in Chapters 2 and 3 of the framework).
- A checklist of evidence accompanies the submission and includes page numbers or other references and demonstrates alignment with the mathematics content standards and, to the extent possible, the framework.
- Mathematical terms are defined and used appropriately, precisely, and accurately.
- Concepts and procedures are explained and are accompanied by examples to reinforce the lessons.
- Opportunities for both mental and written calculations are provided.
- Many types of problems are provided: those that help develop a concept, those that provide practice in learning a skill, those that apply previously learned concepts and skills to new situations, those that are mathematically interesting and challenging, and those that require proofs.
- Ample practice is provided with both routine calculations and more involved multistep procedures in order to foster the automatic use of these procedures and to foster the development of mathematical understanding, which is described in Chapters 1 and 4.
- Applications of mathematics are given when appropriate, both within mathematics and to problems arising from daily life. Applications must not

dictate the scope and sequence of the mathematics program and the use of brand names and logos should be avoided. When the mathematics is understood, one can teach students how to apply it.

- Selected solved examples and strategies for solving various classes of problems are provided.
- Materials must be written for individual study as well as for classroom instruction and for practice outside the classroom.
- Mathematical discussions are brought to closure. Discussion of a mathematical concept, once initiated, should be completed.
- All formulas and theorems appropriate for the grade level should be proved, and reasons should be given when an important proof is not proved.
- Topics cover broad levels of difficulty. Materials must address mathematical content from the standards well beyond a minimal level of competence.
- Attention and emphasis differ across the standards in accordance with (1) the emphasis given to standards in Chapter 3; and (2) the inherent complexity and difficulty of a given standard.
- Optional activities, advanced problems, discretionary activities, enrichment activities, and supplemental activities or examples are clearly identified and are easily accessible to teachers and students alike.
- A substantial majority of the material relates directly to the mathematics standards for each grade level, although standards from earlier grades may be reinforced. The foundation for the mastery of later standards should be built at each grade level.
- An overwhelming majority of the submission is devoted directly to mathematics. Extraneous topics that are not tied to meeting or exceeding the standards, or to the goals of the framework, are kept to a minimum; and extraneous material is not in conflict with the standards. Any nonmathematical content must be clearly relevant to mathematics. Mathematical content can include applications, worked problems, problem sets, and line drawings that represent and clarify the process of abstraction.
- Factually accurate material is provided.
- Principles of instruction are reflective of current and confirmed research.
- Materials drawn from other subject-matter areas are scholarly and accurate in relation to that other subject-matter area. For example, if a mathematics program includes an example related to science, the scientific references must be scholarly and accurate.
- Regular opportunities are provided for students to demonstrate mathematical reasoning. Such demonstrations may take a variety of forms, but they should always focus on logical reasoning, such as showing steps in calculations or giving oral and written explanations of how to solve a particular problem.
- Homework assignments are provided beyond grade three (they are optional prior to grade three).

Program Organization

The sequence and organization of the mathematics program provide structure to what students should learn each year and allow teachers to convey the mathematics content efficiently and effectively. The program content is organized and presented in a manner consistent with achieving the goals of the mathematics content standards. The essential components for program organization are listed as follows:

- Concepts are developed in logical order and increase in depth and complexity during each school year and from grade to grade. Materials for each grade are organized around a few key topics, as described in Chapter 3 of the framework. Although some repetition in the form of review is necessary, review must be for developing automaticity or preparing for further learning. Content for a grade level must not be diluted by an extensive review of skills that have been covered earlier. Substantial new material needs to be introduced at successive levels.
- The order of presentation of mathematical topics is mathematically and pedagogically sound.
- Prerequisite skills and ideas are presented before the more complex topics that depend on them.
- Coverage starts with easy cases and proceeds, step-by-step, to increasingly complex problems within the topic areas.
- The connections between related topics are taught when it is appropriate, and the organization of the material supports the understanding of these connections.
- Mathematical content and instructional activities are sequenced to prevent common student misconceptions (see Chapter 3). Topics that students are likely to confuse are not introduced together, but similarities and differences in ideas and procedures are eventually addressed.
- Student materials ensure that students can look back in the textbook for help with understanding a topic; compilations, such as indices, tables of contents, and review summaries, also provide assistance.
- Materials include tables of contents, indices, and glossaries containing important mathematical terms used in the book to make it easier for parents or others to tutor students. The framework encourages any features of instructional materials that enable older sibling, parental, or other adult tutoring.
- The scope and sequence are referenced in such a way that "looking back and forward" can include previous and subsequent grade levels in the series.
- Materials include an overview of chapters that students are expected to learn with the mathematical concepts involved clearly identified. This material should be available to students, parents, and teachers.

- Problems and exercises based on the students' prior and current experience with the mathematics curriculum are accessible to students.
- Materials are designed so that if students should have trouble with a particular type of problem, guidance is provided to the teachers to help them identify the reason for the difficulty (e.g., identify component skills not mastered), and specific remedies should be suggested.
- Support materials, such as computer programs and manipulatives, are clearly aligned with the mathematical and instructional goals of the mathematics content standards and the framework.
- Applications of the mathematics under discussion must be clearly marked as such and must not be equated with the mathematics itself.
- Materials introduce new concepts at a reasonable pace and provide sufficient instructional and practice material on all the important topics.
- Standards-based goals are explicitly and clearly associated with instruction and assessment.
- Computational and procedural skills, conceptual understanding, and problem solving are interconnected and included throughout the program.

Assessment

Instructional materials should contain strategies and tools for continually measuring student achievement with a reasonable degree of accuracy. Assessments will measure what students know and how well they know it. In keeping with the issues discussed in Chapter 5 of the *Mathematics Framework*, instructional materials must provide teachers with a variety of assessment measures and procedures for different purposes. Assessment programs should include elements of conceptual understanding, basic and procedural skills, and problem solving.

Instructional materials should include:

- Assessments that have content validity and measure individual student progress at regular intervals, that measure each student's entry-level skills and knowledge, that monitor student progress toward meeting the standards, that evaluate mastery of grade-level standards, and that provide summative evaluations of individual student achievement
- Assessments for identifying students who are not making reasonable progress toward achieving the standards
- Opportunities to assess student reasoning across the grades as it progresses from informal explanation to formal proofs
- Measurement of conceptual understanding, basic skills and procedures, and problem solving Instructional materials should provide a variety of assessment measures and procedures for different purposes, including:

- Assessments that are appropriate for different grade levels so that students can check their own work frequently while learning the material and after completing a chapter or unit
- Assessment of appropriate duration at various intervals (e.g., every day, at the end of a lesson or chapter, and at intervals of no more than six weeks)
- Research-based assessments that have content validity
- Both curriculum-embedded assessment and summative assessment
- Multiple methods of assessing what students know and are able to do

Instructional materials must guide the teacher in assessing the student's level at the beginning of the school year. The initial assessment should be comprehensive and help the teacher in determining whether the student should work with the grade-level materials, the materials for the previous grade level, or the transitional materials that teach concepts and skills that should have been previously mastered.

Instructional materials should help teachers use assessment data in instructional planning and reporting, such as:

- Suggestions based on assessment data about ways in which to modify an instructional program so that all students are constantly progressing toward meeting or exceeding the standards
- Suggestions about the type of assessment data to be used to guide decisions about instructional practices
- Suggestions for keeping parents and students informed about student progress

Universal Access[2]

Instructional materials need to provide access to the standards-based curriculum for students with special needs. Programs must conform to the policies of the California State Board of Education and to other applicable state and federal requirements with respect to diverse populations and students with special needs, as discussed in the "Universal Access" chapter of the *Mathematics Framework.*

Materials supporting universal access include:

- Strategies to help the teacher provide access to mathematics for all students with regard to ability, language proficiency, and other special needs.[3]

- A description of methods by which special needs students can experience success with and appreciation of mathematics, from the simplest skills to the most complex understanding.
- Help for teachers to offer the program to students with a wide range of achievement levels, making suggestions for compacting or expanding the curriculum and grouping within or across grade levels.
- Help for students who are below grade level, including more explicit explanations, review, practice, guidance, or other assistance (These students will need extra time and instructional materials devoted to mathematics. It is also important that accommodations for special needs or other low-performing students provide opportunities for them to learn the key concepts in mathematics and not relegate struggling students to meaningless tasks.)
- Alternatives for gifted and talented students that are thoughtful and well conceived and that allow students to accelerate beyond their grade-level content (acceleration) or to study the content in the Mathematics Content Standards in greater depth or complexity (enrichment).
- Information about how teachers might use the results of assessment to differentiate curriculum and instruction at the appropriate level of challenge for all students.
- Suggestions to help teachers preteach and reinforce mathematics vocabulary and concepts with English learners.
- Suggestions to teachers on how and when to modify assessment or instruction for special education pupils.

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[2]**Note**: Also refer to "Special Consideration: Support for Teachers During the Transition Period" for additional guidance as part of the Universal Access criterion.

[3]Note: The California Education Code provides for adopted instructional materials to be translated into braille and large print by the Clearinghouse for Specialized Media and Technology. The Clearinghouse also converts materials into tape and video format as appropriate. Providing student text in digital format (although not required) makes conversion easier.

Instructional Planning and Support

Materials that provide support for teachers need to be built into the program. These materials should contain specific suggestions and illustrative examples of how the teacher can implement a standards-based mathematics program. Instructional materials should meet the following criteria:

- All components of the program are provided so that there is little or no need for teachers to identify, gather, or develop supplementary materials.

- Clear grade-appropriate explanations of mathematical concepts appear in a form that teachers can easily adapt for classroom presentation.
- (Optional) Teacher resources contain full, adult-level explanations and examples of the more advanced mathematics topics that relate to the lesson so that teachers can assess and improve their own knowledge of the subject as necessary. (East Asian lesson plans offer excellent examples showing how this can be done; see Appendix B of the Mathematics Framework.)
- Teacher resources contain discussions of the role of the specific grade-level mathematics in relation to the total kindergarten through grade twelve mathematics curriculum and beyond, describing both what has been previously taught and why and what will be taught in succeeding grades.
- Different kinds of lessons and alternative ways in which to explain concepts are provided to offer teachers choice and flexibility in developing their programs.
- Any required manipulatives are provided, or inexpensive alternatives are suggested.
- Manipulatives should promote student learning, and clear instructions for their efficient use are provided.
- Teacher materials contain sample lesson plans and suggestions for organizing and managing the classroom.
- Tools for assessing student progress and knowledge and suggestions for how to use the assessment data for instructional planning are provided.
- A system is provided for accelerating or decelerating the rate at which new material is introduced to students, in accordance with students' ability to assimilate new material.
- Review and practice distributed over time, as described in Chapter 4 of the Mathematics Framework, is provided to enhance understanding and promote generalization and transfer of skill and knowledge.
- Any instructional software and technological tools used as a format for presentation of the instructional materials are an integral part of the submission.

Special Consideration: Support for Teachers During the Transition Period

(Additional criteria to be considered as part of the Universal Access criterion)

The California mathematics standards aim at a level considerably above that which many students had achieved when the 1999 Mathematics Framework was written. Helping students make the transition to the levels of the standards requires a major effort. During the first two or three years of transition, or perhaps longer, a sixth grade teacher, for example, will most likely use an instructional program aimed at helping many students whose performance level falls far short

of the grade-level standards to catch up. In subsequent years, that teacher may need to use the same instructional program to maintain and expand on the grade-level performance for students who enter the sixth grade already performing at grade level.

Instructional materials should provide a program that will be effective for all students-those who have not mastered most of the content taught in the earlier grades and those who have. Some students may have weaknesses in several areas of content from the earlier grades. This material can be taught within the context of the grade-level textbook. Other students may have such severe problems that it would be unrealistic to assume that the deficits could be remediated with the grade-level textbook.

The hope is that some publishers will directly address the need for transitional materials designed to help students reach the levels of proficiency required in the Mathematics Content Standards. Such transitional materials may be designed for a two-hour block of mathematics instructional time per day, a summer or "off-track" program, or an after-school tutoring program of up to one hour per day. Those publishers should provide transitional materials with content related to the standards, techniques for assessment, and support for teachers. Those topics are discussed in the next sections.

Content Related to the Standards for Transitional Materials

A standards map should be provided showing which standards are addressed and when, with the understanding that the transition materials include standards from several grade levels in a single student or teacher edition. Publishers may consider including transition materials designed to teach the essential content from earlier grades along with the standards for a given grade.

Assessment Tools for Transitional Materials

Assessment materials should be provided to help the teacher determine the student's level of achievement relative to the standards at the beginning of the school year. The initial assessment should be comprehensive so that the teacher can determine which textbook would be appropriate for the student:

- The grade-level textbook
- The grade-level textbook for a previous grade
- Special transitional materials that teach concepts and skills that should have been mastered earlier

Teacher Support for Transitional Materials

Suggestions for teaching students lacking knowledge of certain content cannot be simple afterthoughts to the grade-level material. To develop appropriate instructional plans for these students, teachers need a master guide that enables them to identify foundational skills and associated instructional units taught at earlier grade levels. Materials for students functioning below their grade levels must be designed to accelerate the students' acquisition of critical concepts, procedures, and skills. Another consideration in the development of these materials is that more than one hour a day of instructional time may be devoted to mathematics for students in grades four through twelve who are not performing at grade level. Instructional programs should provide teachers with instructional activities for use during any additionally allocated instructional time. Placement tests and suggestions for instructional strategies should be included to help students whose facility with mathematics enables them to move through the program at an accelerated pace.